



DEPARTMENT OF AGRICULTURE

Rural Utilities Service

7 CFR Part 1728

Specification for 15 kV and 25 kV Primary Underground Power Cable

AGENCY: Rural Utilities Service, USDA.

ACTION: Final rule.

SUMMARY: The Rural Utilities Service (RUS) is amending its regulations regarding electric distribution specifications for 15kV and 25 kV primary underground power cable. This rule will rescind Bulletin 50-70 (U-1), "REA Specification for 15 kV and 25 kV Primary Underground Power Cable," and codify the material which was formerly incorporated by reference. The specifications and standards that appeared in the old RUS Bulletin 50-70 (U-1) will be incorporated by reference and will update the specifications for 15kV and 25kV underground power cable, and provide RUS borrowers with specifications for 35 kV underground power cable for use in 25 kV primary systems. These specifications cover single-phase and multi-phase primary underground power cable which RUS electric borrowers use to construct their rural underground electric distribution systems.

DATES: This rule is effective [INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

Incorporation by Reference: The incorporation by reference of certain publications listed in this rule is approved by the Director of the Federal Register as of [Insert date 30 days after date of publication in the Federal Register]

FOR FURTHER INFORMATION CONTACT: Mr. Trung V. Hiu, Electrical Engineer, Electric Staff Division, Distribution Branch, Rural Utilities Service, United States Department of Agriculture, Room 1262-S, 1400 Independence Avenue, SW., Washington, DC 20250-1569. Telephone: (202) 720-1877. FAX: (202) 720-7491. E-mail: Trung.Hiu@wdc.usda.gov.

SUPPLEMENTARY INFORMATION:

Executive Order 12866

This final rule is exempted from the Office of Management and Budget (OMB) review for purposes of Executive Order 12866 and, therefore, has not been reviewed by OMB.

Executive Order 12372

This final rule is excluded from the scope of Executive Order 12372, Intergovernmental Consultation, which may require consultation with State and local officials. A notice of the final rule entitled “Department Programs and Activities Excluded from Executive Order 12372,” (50 FR 47034) exempted the Rural Utilities Service loans and loan guarantees to from coverage under this order.

Executive Order 12988

This final rule has been reviewed under Executive Order 12988, Civil Justice Reform. The Rural Utilities Service has determined that this rule meets the applicable standards provided in section 3 of the Executive Order. In addition, all state and local laws and regulations that are in conflict with this rule will be preempted. No retroactive effect will be given to this rule and in accordance with section 212(e) of the Department of Agriculture Reorganization Act of 1994 (7 U.S.C. 6912(e)) administrative appeal procedures, if any, must be exhausted before an action against the Department or its agencies may be initiated.

Executive Order 13132

This final rule will not have substantial direct effects on the States, on the relationship between the national government and the States, or on distribution of power and responsibilities among the various levels of government. Under Executive Order 13132, this rule does not have sufficient federalism implications to require preparation of a Federalism Assessment.

Regulatory Flexibility Act Certification

It has been determined that the Regulatory Flexibility Act is not applicable to this rule since the Rural Utilities Service is not required by 5 U.S.C. et seq. or any other provision of law to publish a notice of proposed rulemaking with respect to the subject matter of this final rule.

Information Collection and Recordkeeping Requirements

This final rule contains no additional information collection and recordkeeping requirements and is cleared under control number 0572-0131 pursuant to the Paperwork Reduction Act of 1995 (44 U.S.C. Chapter 35, as amended).

Catalog of Federal Domestic Assistance

The program described by this final rule is listed in the Catalog of Federal Domestic Assistance Programs under No. 10.850, Rural Electrification Loans and Loan Guarantees. This catalog is available on a subscription basis from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402-9325, telephone number (202) 512-1800.

Executive Order 12372

This final rule is excluded from the scope of Executive Order 12372, Intergovernmental Consultation, which may require consultation with State and local officials. See the final rule related notice titled “Department Programs and Activities Excluded from Executive Order 12372” (50 FR 47034), advising that Rural Utilities Service loans and loan guarantees are excluded from the scope of Executive Order 12372.

Unfunded Mandates

This final rule contains no Federal Mandates (under the regulatory provision of title II of the Unfunded Mandates Reform Act of 1995 [2 U.S.C. Chapter 25]) for State, local, and tribal governments or the private sector. Thus, this rule is not subject to the requirements of sections 202 and 205 of the Unfunded Mandates Reform Act of 1995.

National Environmental Policy Act Certification

The Rural Utilities Service has determined that this final rule will not significantly affect the quality of the human environment as defined by the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.). Therefore, this action does not require an environmental impact statement or assessment.

Background

RUS maintains a system of bulletins that contain construction standards and specifications for materials and equipment which must be complied with when system facilities are constructed by electric and telecommunications borrowers in accordance with the loan contract. These standards and specifications contain standard construction units and material items and equipment units commonly used in electric and telecommunications borrowers' systems.

RUS in conjunction with the *Office of the Federal Register* determined that Bulletin 50-70 (U-1), "REA Specification for 15 kV and 25 kV Primary Underground Power Cable," would be codified. The material will now appear in 7 CFR 1728.204. Rescinding Bulletin 50-70 (U-1) and codifying the material in its entirety provides greater convenience for RUS borrowers when searching for specifications and standards requirements. Additionally, the specifications and standards that appeared in the old RUS Bulletin 50-70 (U-1) will be incorporated by reference in 1728.97 and will update the specifications for 15kV and 25kV underground power cable, and provide RUS borrowers with specifications for 35 kV underground power cable for use in 25 kV primary systems. These specifications cover single-phase and multi-phase primary underground power cable which RUS electric borrowers use to construct their rural underground electric

distribution systems. These changes provide standard requirements for 15kV and 25 kV single-phase and multi-phase primary underground power cable with cross-linked polyethylene with tree retardant or ethylene propylene rubber insulation, concentric neutral, and insulating outer jacket and updates the specifications for 15kV and 25 kV primary underground cable while adding specifications for 35 kV primary underground power cable.

The following changes and updates are as follows:

1. Water blocking sealant would be required in all stranded conductor cables.
2. The plain cross-linked polyethylene (XLP) would be removed and be replaced by tree-retardant cross-linked polyethylene (TR-XLPE) as an acceptable insulation material.
3. Nominal insulation thickness on 25 kV cable would be reduced from 345 mils to 260 mils.
4. An optional semi-conducting jacketing material would be added to the specification for cables of all three specified voltages. Cables with semi-conducting jackets may be used by RUS borrowers in areas with soil resistivity greater than 25 ohm-meter, in lieu of using cables with an insulating jacket to help improve the effectiveness of system grounding in locations of high soil resistivity.

Summary of Comments

A proposed rule entitled “Specifications for Primary Underground Power Cable,” was published August 30, 2007, at 72 FR 50081, invited interested parties to submit comments. The National Rural Electric Cooperative Association Transmission and Distribution (NRECA T&D) Engineering Underground Subcommittee and the cable manufacturers – Prysmian Cables &

Systems (PCS), Southwire, General Cable, Nexans Energy, Hendrix Wire and Cable (HWC), submitted comments. No comments from any other sources were received. The comments submitted by NRECA represent the views of its members.

Comment: NRECA T&D suggested adding the abbreviations IEEE, LDPE, LLDPE, MDPE and HDPE to the "Abbreviations" section.

Agency Response: RUS agrees with the recommendation and has revised the final rule accordingly.

Comment: PCS suggested removing the word “insulating” as this implies a voltage rating for the jacket. Jackets do not have a voltage rating per the National Electrical Code (NEC).

Agency Response: RUS agrees with the recommendation and has revised the final rule accordingly.

Comment: Southwire suggested updating the publication dates of reference standards and adding ASTM B835-04, B836-00 (2005), B901-04, B902-04a standards.

Agency Response: RUS agrees with the recommendation and has revised the final rule Accordingly

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Comment: Southwire, NRECA T&D, General Cable, and Nexans suggested adding Insulated Cable Engineers Association, Inc. (ICEA) to the list of addresses.

Agency Response: RUS agrees with the recommendation and has revised the final rule accordingly.

Comment: General Cable suggested adding the address: IHS; 15 Inverness Way East; Englewood, CO 80112; Telephone: 800-854-7179; Web Site: <http://www.globe,ihs.com> (7, section 3b, “Availability of Publications”).

Agency Response: RUS agrees with the recommendation and has revised the final rule accordingly.

Comment: Southwire recommended adding compressed and compact round stranded copper conductors using single input wire construction in accordance with ASTM B902--4a and B835-04 to this section.

Agency Response: RUS agrees with the recommendation and has revised the final rule accordingly.

Comment: PCS suggested correcting the "R14" in the first line to "H14". This was a typo.

Agency Response: RUS agrees with the recommendation and has revised the final rule accordingly.

Comment: General Cable, Nexans Energy, PCS, and Southwire suggested the following changes: Central aluminum phase conductors shall be one on the following:

This part should be changed to 4d which would require the conductor to be filled whether it be copper or aluminum. The requirement to fill the conductor interstices so as not to allow moisture to migrate through the conductor should be for both aluminum and copper conductor and not just for aluminum conductor. Filling the strands of a conductor is done to pick moisture out to the conductor and whereby limiting the moisture that can migrate into the insulation.

Agency Response: RUS agrees with the recommendation and has revised the final rule accordingly.

Comment: PCS suggested replacing the word "moisture" with the word "water". The test protocol is a Water penetration test.

Agency Response: RUS agrees with the recommendation and has revised the final rule accordingly.

Comment: All cable manufacturers recommended removing the requirement for indent printing on a solid conductor. Requiring indent print on solid conductors does not seem consistent with keeping the interface of the conductor and extruded components smooth. Using indent on a solid conductor will cause the surface of the conductor have some metal displacement and create irregularities on the conductor surface. Indent printing on the center strand of a stranded conductor is being used today on cables and this type of identification should be limited to stranded conductor and not used on solid conductor use for medium voltage cables.

Agency Response: RUS agrees with the recommendation and has revised the final rule.

Comment: Conductor Shield, NRECA T&D suggested adding (for discharge resistant EPR) after the first word "insulating" - "The void and protrusion limits on the conductor shield shall be in compliance with ANSI/ICEA S-94-649" as was done in the Insulation Shield Section (or state the actual limits).

Agency Response: The RUS agrees with the recommendation and has added "The void and protrusion limits on the conductor shield shall be in compliance with ANSI/ICEA S-94-649".

Comment: PCS suggested replacing the words "An insulating" with "A non-conducting". This will align the wording with ANSI/ICEA S-94-649 standard.

Agency Response: RUS agrees with the recommendation and has revised the final rule.

Comment: Insulation, NRECA T&D suggested adding "The void and protrusion limits on the insulation shall be in compliance with ANSI/ICEA S-94-649" as was done in the Insulation Shield Section (or state the actual limits).

Agency Response: RUS agrees with the recommendation and has added "The void and protrusion limits on the conductor shield shall be in compliance with ANSI/ICEA S-94-649".

Comment: PCS suggested removing the words inside the parentheses "(e.g., cross-linked polyethylene shield may be used with EPR insulation)". The term "thermosetting polymeric layer" sets forth the requirement sufficiently. As a matter of technical clarification, the insulation shield materials are not XLPE but are in fact a co-polymer material. Polymeric layer is a good way to refer to these materials.

Agency Response: RUS agrees with the recommendation and has revised the final rule.

Comment: PCS stated there is no technical justification to have different minimum stripping tensions for EPR and TRXLPE. This requirement needs to be changed so both materials have the same minimum tension of 3 pounds as required by the ANSI approved industry standard.

Agency Response: Stripping tensions values shall be 3 through 18 pounds (1.36 through 8.16 kg) for EPR discharge free and TR-XLPE cables. Discharge resistant cables shall have strip tension of 0 through 18 pounds (0 through 8.16 kg).

Comment: General Cable suggested changing the requirement of stripping tension for TR-XLPE cable to the industry standard of a maximum of 24 lb. Limiting the maximum stripping tension to 18 lb will cause quality cable to be rejected based on a difference of 6 lb. The industry standards require that the cables be able to be stripped at temperatures between -10c and 40c without tearing based on a defined test procedure regardless of the actual stripping tension.

Agency Response: Stripping tensions values shall be 3 through 18 pounds (1.36 through 8.16 kg) for EPR discharge free and TR-XLPE cables. Discharge resistant cables shall have strip tension of 0 through 18 pounds (0 through 8.16 kg).

Comment: HWC suggested the minimum strip tension should be 3 pounds for both EPR and TR0XLPE discharge free cable designs as required by the referenced ANSI/ICEA Standard. Specifying a difference without a technical basis would only serve to provide a justified commercial advantage.

Agency Response: Stripping tensions values shall be 3 through 18 pounds (1.36 through 8.16 kg) for EPR discharge free and TR-XLPE cables. Discharge resistant cables shall have strip tension of 0 through 18 pounds (0 through 8.16 kg).

Comment: Nexans Energy suggested the minimum strip tension of 3 lbs. should be applicable to both EPR and TR-XLPE.

Agency Response: Stripping tensions values shall be 3 through 18 pounds (1.36 through 8.16 kg) for EPR discharge free and TR-XLPE cables. Discharge resistant cables shall have strip tension of 0 through 18 pounds (0 through 8.16 kg).

Comment: PCS suggested the word “uncoated” in the beginning of the second line should be removed as some manufacturers will only provide flat straps tin-coated and there is no technical reason to not allow this construction.

Agency Response: RUS disagrees and its previous experience indicates tin-coated neutral may accelerate corrosion at holidays. RUS will not allow tin-coated neutral.

Comment: PCS suggested this paragraph to read as follows: "The jacket type shall be an Extruded-to-Fill Jacket that fills the area between the concentric neutral wires and covers the wires to the proper thickness. The jacket shall be free stripping. The jacket shall have three red stripes longitudinally extruded into the jacket surface 120 degrees apart per ANSI/ICEA S-94-649."

Agency Response: RUS disagrees and the current text is in an acceptable format and remains unchanged..

Comment: PCS stated ICEA does a good job specifying the jacket materials. ASTM has requirements that only pertain to base resins which typically can not be measured on compounds received or have pertinence to the performance of the jacket material in its intended environment. The Extruded-to-Fill jacket materials are limited to LLDPE and LDPE. The

references to (insulating) and to the ASTM D1248 specification should be removed. This paragraph should be changed to "Nonconducting jackets shall be LDPE or LLDPE compound meeting the requirements of ANSI/ICEA S-94-649."

Agency Response: RUS agrees with the recommendation and has revised the final rule accordingly.

Comment: NRECA T&D suggested checking with Dow Chemical and/or Borealis to confirm the vapor transmission rate of 2 g/m²/24 hours is valid for current semi-conducting jacket compounds.

Agency Response: RUS has verified and confirmed with Dow Chemical of the current physical properties specification of the DOW DHDA-7708 Black moisture vapor transmission rate at 38 degree C, 90% RH is 1.5 gms/m²/24 hrs (ASTME96).

Comment: PCS stated this paragraph indicates a maximum moisture vapor transmission rate of 2 g/m²/24 hours at 38⁰C and 96% relative humidity in accordance with ASTM E 96. They believe there is no test data to support there are materials commercially available to meet this maximum value. They suggest that this value be removed.

Agency Response: RUS has verified and confirmed with Dow Chemical of the current physical properties specification of the DOW DHDA-7708 Black moisture vapor transmission rate at 38 degree C, 90% RH is 1.5 gms/m²/24 hrs (ASTME96).

Comment: "Overall Outer Jacket", paragraph a (3), Southwire stated the requirement for maximum moisture transmission rate of 2 g/m²/24 hours at 38⁰C (100⁰F) and 96% relative

humidity in accordance with ASTM E 96 does not agree with existing data sheets from the material provider, Dow Chemical. Their product was tested at 90%RH. Southwire suggested this requirement be verified with the material supplier or deleted.

Agency Response: RUS has verified and confirmed with Dow Chemical of the current physical properties specification of the DOW DHDA-7708 Black moisture vapor transmission rate at 38 degree C, 90% RH is 1.5 gms/m²/24 hrs (ASTME96).

Comment: "Overall Outer Jacket", paragraph a (3), Southwire suggested the word "maximum" should be added to the first sentence --- Semi-conducting jackets shall have a maximum radial resistivity of 100 ohm-meter.

Agency Response: RUS agrees with the recommendation and has revised the final rule accordingly.

Comment: NRECA T& D, General Cable, PCS, Nexans Energy, and Southwire suggested deleting Dimensional Tolerances - this section come from the old U-1 and ICEA S-94-649 has minimum and maximum tolerances on each layer of the cable construction but not on the overall cable core. There is an Appendix C in ICEA to calculate these tolerances and they will vary greatly by conductor size and insulation thickness.

Agency Response: RUS agrees with the recommendation and has revised the final rule accordingly.

Comment: General Cable suggested changing "Partial Discharge Tests" to Discharge Tests: Manufacturers shall demonstrate that their cable meets either the partial discharge test for

Discharge Free cable design or the Discharge Resistance test for Discharge Resistant cable designs as required per ICEA S-94-649 and as described in b(1) or b(2) of this bulletin.

Agency Response: RUS disagrees. The current text is acceptable.

Comment: Jacket tests, cable manufacturers suggested the (cold bend test) requirement be omitted. Since polyethylene's (low, medium and high density) have excellent cold temperature properties, there is no need to do cold bend test. ICEA standards do not require a cold bend test for these jacket materials for the reason stated above. Jacket material such as Polyvinyl Chloride (PVC) and Chlorinated Polyethylene (CPE) do require a cold bend test but are not allowed to be used in this specification.

Agency Response: RUS agrees with the recommendation and has revised the final rule accordingly.

Comment: HWC suggested that jacket type is only printed if the jacket is semi-conducting as required by the referenced ANSI/ICEA Standard.

Agency Response: RUS disagrees. The current text and format are acceptable.

Comment: PCS stated the cable reel is not for protection but to allow ease of handling and installation of the cable. They recommend that the purchaser define the class of reels and reel covering material that one want specified per NEMA WC26. The reel and covering should be at the mutual agreement of the purchaser and the manufacturer.

Agency Response: RUS disagrees. The current text and requirement are acceptable.

List of Subjects in 7 CFR Part 1728

Electric power, Incorporation by reference, Loan programs-energy, Rural areas.

For the reasons set out in the preamble, 7 CFR part 1728 is amended as follows:

PART 1728 – ELECTRIC STANDARDS AND SPECIFICATIONS FOR MATERIALS AND CONSTRUCTION

1. The authority citation for part 1728 continues to read as follows:

Authority: 7 U.S.C. 901 et seq., 7 U.S.C. 1921 et seq.; 7 U.S.C. 6941 et seq.

2. In §1728.97, redesignate paragraphs (e), (f), and (g) as paragraphs (f), (h), and (i), respectively, revise paragraph (d), and add new paragraphs (e) and (g) to read as follows:

§1728.97 Incorporation by reference of electric standards and specifications.

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- (d) The American National Standards Institute/Insulated Cable Engineers Association, Inc. (ANSI/ICEA) makes the following material available for purchase from Global Engineering

Documents for a fee at the following address: IHS Global Engineering Documents, 15 Inverness Way East, Englewood, CO 80112, Phone: (303) 397-7956; (800)-854-7179, Fax: (303) 397-2740, E Mail: global@ihs.com, Web Site: <http://global.ihs.com>

(1) ANSI/ICEA S-94-649-2004 – Standard for Concentric Neutral Cables Rated 5 Through 46 KV (ANSI/ICEA S-94-649-2004), approved September 20, 2005, incorporation by reference approved for §1728.204

(2) ANSI/ICEA T-31-610-2007 – Test Method for Conducting Longitudinal Water Penetration Resistance Tests on Blocked Conductors (ANSI/ICEA T-31-610-2007), approved October 31, 2007, incorporated by reference approved for §1728.204.

(e) Copies of American Society for Testing and Materials (ASTM) publications referenced in this specification can be obtained from ASTM for a fee at the following address: ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, Telephone: (610) 832-9585, Web Site: <http://astm.org>.

(1) ASTM B 3-01 (Reapproved 2007) – Standard Specification for Soft or Annealed Copper Wire, (ASTM B 3-01) approved March 15, 2007, incorporated by reference approved for §1728.204.

(2) ASTM B 8-04 – Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft (ASTM B 8-04), approved April 1, 2004, incorporated by reference approved for §1728.204.

(3) ASTM B 230/B 230M-07 – Standard Specification for Aluminum 1350-H19 Wire for Electrical Purposes (ASTM B 230/B 230M-07), approved March 15, 2007, incorporated by

reference approved for §1728.204.

(4) ASTM B 231/B 231M-04 – Standard Specification for Concentric-Lay-Stranded Aluminum 1350 Conductors (ASTM B 231/B 231M-04), approved April 1, 2004, incorporated by reference approved for §1728.204.

(5) ASTM B 400-08 – Standard Specification for Compact Round Concentric-Lay-Stranded Aluminum 1350 Conductors (ASTM B 400-08), approved September 1, 2008, incorporated by reference approved for §1728.204.

(6) ASTM B 496-04 – Standard Specification for Compact Round Concentric-Lay-Stranded Copper Conductors (ASTM B 496-04), approved April 1, 2004, incorporated by reference approved for §1728.204.

(7) ASTM B 609/B 609M-99 – Standard Specification for Aluminum 1350 Round Wire, Annealed and Intermediate Tempers, for Electrical Purposes (ASTM B 609/B 609M-99), approved April 1, 2004, incorporated by reference approved for §1728.204.

(8) ASTM B 786-08 – Standard Specification for 19 Wire Combination Unilay-Stranded Aluminum 1350 Conductors for Subsequent Insulation (ASTM B 786-08), approved September 1, 2008, incorporated by reference approved for §1728.204.

(9) ASTM B 787/B 787M-04 – Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation (ASTM B 787/B 787M-04), approved September 1, 2004, incorporated by reference approved for §1728.204.

(10) ASTM B 835-04 – Standard Specification for Compact Round Stranded Copper Conductors Using Single Input Wire Construction (ASTM B 835-04), approved September 1, 2004, incorporated by reference approved for §1728.204.

(11) ASTM B902-04a – Standard Specification for Compressed Round Stranded Copper Conductors, Hard, Medium-Hard, or Soft Using Single Input Wire Construction (ASTM B902-04a), approved September 1, 2004, incorporated by reference approved for §1728.204.

(12) ASTM D 1248-05 – Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable (ASTM D 1248-05), approved March 1, 2005, incorporated by reference approved for §1728.204.

(13) ASTM D 2275-01 (Reapproved 2008) – Standard Test Method for Voltage Endurance of Solid Electrical Insulating Materials Subjected to Partial Discharges (Corona) on the Surface (ASTM D 2275-01), approved May 1, 2008, incorporated by reference approved for §1728.204.

(14) ASTM E 96/E 96M-05 – Standard Test Methods for Water Vapor Transmission of Materials (ASTM E 96/E 96M-05), approved May 1, 2005, incorporated by reference approved for §1728.204.

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(g) The following material is available from the Insulated Cable Engineers Association (ICEA) and may be purchased from Global Engineering Documents for a fee at the following address: IHS Global Engineering Documents, 15 Inverness Way East, Englewood, CO 80112, Phone: (303) 397-7956; (800)-854-7179, Fax: (303) 397-2740, E Mail: global@ihs.com, Web Site: <http://global.ihs.com>.

(1) ICEA T-32-645-93 – Guide for Establishing Compatibility of Sealed Conductor Filler Compounds with Conducting Stress Control Materials (ICEA T-32-645-93), approved February 1993, incorporated by reference approved for §1728.204.

(2) [Reserved]

3. Add and reserve new § 1728.203 to read as follows:

§ 1728.203 [Reserved]

4. Add new § 1728.204 to read as follows:

§ 1728.204 Electric standards and specifications for materials and construction.

(a) General specifications. This section details requirements for 15 and 25 kV single phase, V-phase, and three-phase power cables for use on 12.5/7.2 kV (15 kV rated) and 24.9/14.4 kV (25 kV rated) underground distribution systems with solidly multi-grounded neutral. Cable complying with this specification shall consist of solid or strand-filled conductors which are insulated with tree-retardant cross-linked polyethylene (TR-XLPE) or ethylene propylene rubber (EPR), with concentrically wound copper neutral conductors covered by a nonconducting or semiconducting jacket. 35 kV rated cables may be used in 24.9/14.4 kV application where additional insulation is desired.

(1) The cable may be used in single-phase, two (V)-phase, or three-phase circuits.

(2) Acceptable conductor sizes are: No. 2 AWG (33.6 mm²) through 1000 kcmil (507 mm²) for 15 kV cable, No. 1 AWG (42.4 mm²) through 1000 kcmil (507 mm²) for 25 kV, and 1/0 (53.5 mm²) through 1000 kcmil (507 mm²) for 35 kV cable.

(3) Except where provisions therein conflict with the requirements of this specification, the cable shall meet all applicable provisions of ANSI/ICEA S-94-649-2004 (incorporated by reference in §1728.97). Where provisions of the ANSI/ICEA specification conflict with this section, §1728.204 shall apply.

(b) Definitions. As used in this section:

Agency refers to the Rural Utilities Service (RUS), an agency of the United States Department of Agriculture's (USDA), hereinafter referred to as the Agency.

EPR Insulating Compound is a mixture of ethylene propylene base resin and selected ingredients.

TR-XLPE Insulating Compound is a tree retardant crosslinked polyethylene (TR-XLPE) insulation compound containing an additive, a polymer modification filler, which helps to retard the growth of electrical trees in the compound.

(c) Phase conductors. (1) Central phase conductors shall be copper or aluminum as specified by the borrower within the limit of § 1728.204(a)(2).

(2) Central copper phase conductors shall be annealed copper in accordance with ASTM B 3-01 (incorporated by reference in §1728.97). Concentric-lay-stranded phase conductors shall conform to ASTM B 8-04 (incorporated by reference in §1728.97) for Class B stranding. Compact round concentric-lay-stranded phase conductors shall conform to ASTM B 496-04 (incorporated by reference in §1728.97). Combination unilay stranded phase conductors shall conform to ASTM B 787/B 787M-04 (incorporated by reference in §1728.97). Compact round stranded copper conductors using single input wire construction shall conform to ASTM B835-04 (incorporated by reference in §1728.97). Compressed round stranded copper

conductors, hard, medium-hard, or soft using single input wire construction shall conform to ASTM B902-04a (incorporated by reference in §1728.97). If not specified, stranded phase conductors shall be Class B stranded.

(3) Central aluminum phase conductors shall be one of the following:

(i) Solid: Aluminum 1350 H12 or H22, H14 or H24, H16 or H26, in accordance with ASTM B 609/B 609M-99 (incorporated by reference in §1728.97).

(ii) Stranded: Aluminum 1350 H14 or H24, H142 or H242, H16, or H26, in accordance with ASTM B 609/B 609M-99 (incorporated by reference in §1728.97) or Aluminum 1350-H19 in accordance with ASTM B 230/B 230M-07 (incorporated by reference in §1728.97).

Concentric-lay-stranded (includes compacted and compressed) phase conductors shall conform to ASTM B 231/B 231M-04 (incorporated by reference in §1728.97) for Class B stranding.

Compact round concentric-lay-stranded phase conductors shall conform to ASTM B 400-08 (incorporated by reference in §1728.97). Combination unilay stranded aluminum phase conductors shall conform to ASTM B 786-08 (incorporated by reference in §1728.97). If not specified, stranded phase conductors shall be class B stranded.

(4) The interstices between the strands of stranded conductors shall be filled with a material designed to fill the interstices and to prevent the longitudinal migration of water that might enter the conductor. This material shall be compatible with the conductor and conductor shield materials. The surfaces of the strands that form the outer surface of the stranded conductor shall be free of the strand fill material. Compatibility of the strand fill material with the conductor shield shall be tested and shall be in compliance with ICEA T-32-645-93 (incorporated by reference in §1728.97). Water penetration shall be tested and shall be in compliance with ANSI/ICEA T-31-610-2007 (incorporated by reference in §1728.97).

(5) The center strand of stranded conductors shall be indented with the manufacturer's name and year of manufacture at regular intervals with no more than 12 inches (0.3 m) between repetitions.

(d) Conductor shield (stress control layer). A non-conducting (for discharge resistant EPR) or semi-conducting shield (stress control layer) meeting the applicable requirements of ANSI/ICEA S-94-649-2004 (incorporated by reference in §1728.97) shall be extruded around the central conductor. The minimum thickness at any point shall be in accordance with ANSI/ICEA S-94-649-2004. The void and protrusion limits on the conductor shield shall be in compliance with ANSI/ICEA S-94-649-2004. The shield shall have a nominal operating temperature equal to, or higher than, that of the insulation.

(e) Insulation. (1) The insulation shall conform to the requirements of ANSI/ICEA S-94-649-2004 (incorporated by reference in §1728.97) and may either be tree retardant cross-linked polyethylene (TR-XLPE) or ethylene propylene rubber (EPR), as specified by the borrower. The void and protrusion limits on the insulation shall be in compliance with ANSI/ICEA S-94-649-2004.

(2) The thickness of insulation shall be as follows:

Cable Rated	Nominal	Minimum	Maximum
Voltage	Thickness	Thickness	Thickness
15 kV	220 mils (5.59 mm)	210 mils (5.33 mm)	250 mils (6.35 mm)
25 kV	260 mils (6.60 mm)	245 mils (6.22 mm)	290 mils (7.37 mm)
35 kV	345 mils (8.76 mm)	330 mils (8.38 mm)	375 mils (9.53 mm)

(f) Insulation shield. (1) A semi-conducting thermosetting polymeric layer meeting the requirements of ANSI/ICEA S-94-649-2004 (incorporated by reference in §1728.97) shall be extruded tightly over the insulation to serve as an electrostatic shield and protective covering. The shield compound shall be compatible with, but not necessarily the same material composition as, that of the insulation (e.g., cross-linked polyethylene shield may be used with EPR insulation). The void and protrusion limits on the semi-conducting shields shall be in compliance with the ANSI/ICEA S-94-649-2004.

(2) The thickness of the extruded insulation shield shall be in accordance with ANSI/ICEA S-94-649-2004 (incorporated by reference in §1728.97).

(3) The shield shall be applied such that all conducting material can be easily removed without the need for externally applied heat. Stripping tension values shall be 3 through 18 pounds (1.36 through 8.16 kg) for TR-XLPE and EPR discharge free cables. Discharge resistant cables shall have strip tension of 0 through 18 pounds (0 through 8.16 kg).

(4) The insulation shield shall meet all applicable tests of ANSI/ICEA S-94-649-2004 (incorporated by reference in §1728.97).

(g) Concentric neutral conductor. (1) Concentric neutral conductor shall consist of annealed round, uncoated copper wires in accordance with ASTM B 3-01 (incorporated by reference in §1728.97) and shall be spirally wound over the shielding with uniform and equal spacing between wires. The concentric neutral wires shall remain in continuous intimate contact with the extruded insulation shield. Full neutral is required for single phase and 1/3 neutral for three

phase applications unless otherwise specified. The minimum wire size for the concentric neutral is 16 AWG (1.32 mm²).

(2) When a strap neutral is specified by the borrower, the neutral shall consist of uncoated copper straps applied concentrically over the insulation shield with uniform and equal spacing between straps and shall remain in intimate contact with the underlying extruded insulation shield. The straps shall not have sharp edges. The thickness of the flat straps shall be not less than 20 mils (0.5 mm).

(h) Overall outer jacket. (1) An electrically nonconducting (insulating) or semi-conducting outer jacket shall be applied directly over the concentric neutral conductors.

(2) The jacket material shall fill the interstice area between conductors, leaving no voids. The jacket shall be free stripping. The jacket shall have three red stripes longitudinally extruded into the jacket surface 120° apart.

(3) Nonconducting jackets shall consist of low density, linear low density, medium density, or high density HMW black polyethylene (LDPE, LLDPE, MDPE, HDPE) compound meeting the requirements of ANSI/ICEA S-94-649-2004 (incorporated by reference in §1728.97) and ASTM D 1248-05 (incorporated by reference in §1728.97) for Type I, Class C, Category 4 or 5, Grade J3 before application to the cable. Polyvinyl chloride (PVC) and chlorinated polyethylene (CPE) jackets are not acceptable.

(4) Semi-conducting jackets shall have a maximum radial resistivity of 100 ohm-meter and a maximum moisture vapor transmission rate of 1.5 g/m²/24 hours at 38° C (100° F) and 90 percent relative humidity in accordance with ASTM E 96/E96M-05 (incorporated by reference in §1728.97).

(5) The minimum thickness of the jacket over metallic neutral wires or straps shall comply with the thickness specified in ANSI/ICEA S-94-649-2004 (incorporated by reference in §1728.97).

(i) Tests. (1) As part of a request for Agency consideration for acceptance and listing, the manufacturer shall submit certified test data results to the Agency that detail full compliance with ANSI/ICEA S-94-649-2004 (incorporated by reference in §1728.97) for each cable design.

(i) Test results shall confirm compliance with each of the material tests, production sampling tests, tests on completed cable, and qualification tests included in ANSI/ICEA S-94-649-2004 (incorporated by reference in §1728.97).

(ii) The testing procedure and frequency of each test shall be in accordance with ANSI/ICEA S-94-649-2004 (incorporated by reference in §1728.97).

(iii) Certified test data results shall be submitted to the Agency for any test, which is designated by ANSI/ICEA S-94-649-2004 (incorporated by reference in §1728.97) as being “for Engineering Information Only,” or any similar designation.

(2) Partial discharge tests. Manufacturers shall demonstrate that their cable is not adversely affected by excessive partial discharge. This demonstration shall be made by completing the procedures described in paragraphs (i)(2)(i) and (i)(2)(ii) of this section.

(i) Each shipping length of completed cable shall be tested and have certified test data results available indicating compliance with the partial discharge test requirements in ANSI/ICEA S-94-649-2004 (incorporated by reference in §1728.97).

(ii) Manufacturers shall test production samples and have available certified test data results indicating compliance with ASTM D 2275-01 (incorporated by reference in §1728.97) for

discharge resistance as specified in the ANSI/ICEA S-94-649-2004 (incorporated by reference in §1728.97). Samples of insulated cable shall be prepared by either removing the overlying extruded insulation shield material, or using insulated cable before the extruded insulation shield material is applied. The sample shall be mounted as described in ASTM D 2275-01 and shall be subjected to a voltage stress of 250 volts per mil of nominal insulation thickness. The sample shall support this voltage stress, and not show evidence of degradation on the surface of the insulation for a minimum of 100 hours. The test shall be performed at least once on each 50,000 feet (15,240 m) of cable produced, or major fractions thereof, or at least once per insulation extruder run.

(3) Jacket tests. Tests described in paragraph (i)(3)(i) of this section shall be performed on cable jackets from the same production sample as in paragraphs (i)(2)(i) and (i)(2)(ii) of this section.

(i) A Spark Test shall be performed on nonconducting jacketed cable in accordance with ANSI/ICEA S-94-649-2004 (incorporated by reference in §1728.97) on 100 percent of the completed cable prior to its being wound on shipping reels. The test voltage shall be 4.5 kV AC for cable diameters < 1.5 inches and 7.0 kV for cable diameters > 1.5 inches, and shall be applied between an electrode at the outer surface of the nonconducting (insulating) jacket and the concentric neutral for not less than 0.15 second.

(ii) [Reserved]

(4) Frequency of sample tests shall be in accordance with ANSI/ICEA S-94-649-2004 (incorporated by reference in §1728.97).

(5) If requested by the borrower, a certified copy of the results of all tests performed in accordance with this section shall be furnished by the manufacturer on all orders.

(j) Miscellaneous. (1) All cable provided under this specification shall have suitable markings on the outer surface of the jacket at sequential intervals not exceeding 2 feet (0.61 m). The label shall indicate the name of the manufacturer, conductor size, type and thickness of insulation, center conductor material, voltage rating, year of manufacture, and jacket type. There shall be no more than 6 inches (0.15 m) of unmarked spacing between texts label sequence. The jacket shall be marked with the symbol required by Rule 350G of the National Electrical Safety Code and the borrower shall specify any markings required by local safety codes. This is in addition to extruded red stripes required in this section.

(2) Watertight seals shall be applied to all cable ends to prevent the entrance of moisture during transit or storage. Each end of the cable shall be firmly and properly secured to the reel.

(3) Cable shall be placed on shipping reels suitable for protecting it from damage during shipment and handling. Reels shall be covered with a suitable covering to help provide physical protection to the cable.

(4) A durable label shall be securely attached to each reel of cable. The label shall indicate the purchaser's name and address, purchase order number, cable description, reel number, feet of cable on the reel, tare and gross weight of the reel, and beginning and ending sequential footage numbers.

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Jonathan Adelstein
Administator
Rural Utilities Service

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